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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS OF THE USSR

(Selected Translations)

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This report contains the translations of two articles published in Metallovedeniye i termicheskaya obrabotka metallov (Metallurgy and Heat Treatment of Metals), No 4, Moscow, April 1961. Additional bibliographic information accompanies each item.

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Results of the 1960 All-Union Competitions for the
D. K. Chernov and N. A. Minkevich Prizes

(by S. L. Rustem)

The purpose of the competition for the D. K. Chernov Prize is to encourage better scientific research papers and monographs in the crystallization and phase conversions of metal alloys, the theory of alloying, the study of the physical principals and methods of increasing the strength and yield of heat-resistant alloys, instrument steels, and alloys with special physical properties, the development of new techniques for raising the stability and strength of metal surfaces, and the perfection of physical-chemical analysis of metals and mechanical testing.

The jury of the competition awarded the first prize of 500 rubles to Doctor of Engineering Sciences Prof. A. P. Gulyayev for his book Termicheskaya obrabotka stali (Heat Treatment of Steel) (State Scientific and Technical Publishing House of Literature on Machinery, 1960).

The book is devoted to the theory and practice of the heat and chemical-thermal treatment of steel. The following topics are considered in order in the book: formation of austenite upon heating, austenite decomposition at different cooling rates, nature of bainite and martensite, decomposition of martensite during anneal, and the properties of the structural components of steel formed as the result of heat treatment.

In the section "Heat Treatment in Practice" the operations of annealing, tempering, and normalizing steel and the surface and chemical-thermal treatment of steel are described in detail.

Second prizes of 300 rubles were awarded as follows:

1. To Candidate of Engineering Sciences M. L. Bernshteyn for his paper "Magnetic Thermomechanical Treatment of Metals and Alloys."

In the paper the process of thermal-mechanical treatment of iron and carbon steels, consisting in the deformation of austenite by cold hardening (without recrystallization) with subsequent martensitic transition, is investigated. In the transition an external magnetic field is imposed. The mechanical properties of steel are enhanced as the result of the favorable orientation of the crystals, which are broken up in connection with directional phase hardening and magnetostriction upon attaining saturation magnetization.

The paper was published in the journal Metallovedeniye i termicheskaya obrabotka metallov /Metallurgy and the Heat Treatment of Metals/, No 10, 1960.

2. To Candidate of Engineering Sciences B. A. Movchan for his paper "Origin of the Structure and Certain Properties of the Crystallite Boundaries in Cast Metals and Alloys."

The paper is devoted to a highly important theoretical problem, the

study of the nature, mechanism of formation, and properties of the secondary crystal boundaries in cast metals after crystallization. The practical importance of the paper is very great, for it enables one to explain the cause of intercrystalline destruction of metals and gives approaches to its circumvention.

The paper was published in Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk; Metallurgiya i toplivo [Bulletin of the Academy of Sciences USSR, Engineering Sciences Division; Metallurgy and Fuel], No 5, 1959.

3. To Doctors of Engineering Sciences M. V. Pridantsev and G. V. Estulin for their paper "Effect of Alloying Elements Having a Low Solubility in Solid Nickel-Chrome Solutions on the Properties of Heat-Resistant Alloys with a Nickel Base."

The authors investigated the influence of the elements on the properties and structure of alloys of the type Kh20N80T, which are an important group of highly heat resistant alloys. As a result of their investigations a vast amount of data was assembled on the heat resistance and other properties of alloys, and valuable information was obtained on the alloy composition dependence of the properties. Certain conclusions are made regarding the rational compositions and alloying limits of alloys.

The paper was published in the journal Stal' (Steel), Nos 9 and 10, 1960.

Third prizes of 100 rubles were awarded as follows:

1. To A. A. Gorshkov, M. V. Volshchenko, K. K. Prozhoga, I. K. Udovikov, and A. I. Toropov for their paper "Enhancement of the Physical-Mechanical Properties of High-Test Pig Iron with Globular Graphite for the Production of Cast Crankshafts."

The authors worked out a new approach to isothermal treatment, the outcome of which was the new type VCh 90-2 pig iron. Their great achievement lay in the fact that these results were obtained not only under laboratory conditions but in the industrial environment as well.

2. To M. G. Taubina, Ye. M. Pivnik, N. Ya. Karasik, and N. E. Shlepyanova for their paper "Investigation of Structural Transformations in Type EI572 Steel Under Conditions of Prolonged Soaking."

The authors studied phase conversions and during the course of prolonged aging, and discovered intermetallic phases, similar to the sigma phase and arbitrarily called "sigma one" after 20,000 hours at 600° and "sigma two" after 30,000 hours at 650°.

An important result of the study is that, in spite of all the conversions taking place, the linear logarithmic "stress-time" relation is not violated until breakdown after aging for 32,000 hours.

Honorary recognition was granted to the following by the Central Administration of the Scientific and Technical Division of the Machinery Industry:

1. To Engineer L. B. Getsov for his paper "Behavior of Heat Resistant Materials with Cyclic Temperatures and Stresses."

The data presented in this paper, as well as the conclusions drawn from them, are of practical and theoretical significance.

The paper was published in the journals Teploenergetika /Thermal Power Engineering/, No 9, 1960 and Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk /Bulletin of the Academy of Sciences USSR, Engineering Sciences Division/, No 6, 1960.

2. To Candidate of Engineering Sciences L. Ya. Liberman and Engineer M. N. Sokolov for their paper "Investigation of the Heat-Resistance Characteristics of Bolt Steels."

The paper is devoted to an investigation of heat-resistance criteria and the determination of optimum chemical composition and conditions of heat treatment of heat-resistant reinforcing steels. The industrial utilization of the new steel makes it possible to substitute the less costly perlite steel for expensive nickel steels.

The purpose of the competition for the N. A. Minkevich Prize is to stimulate better studies on the development and utilization of technological processes and modern types of facilities for the heat treatment of metals.

Papers that may be entered in the competition are those on methods of advanced technology of heat and chemical-thermal treatment, scientific research in the technology, organization, and equipment for heat treatment, original designs of thermal installations (furnaces, furnace-bath combinations, assemblies), plans and layouts for the over-all mechanization and automation of technological processes, modern methods of thermal processing in specific technological processes (mass production lines, etc.), technical improvements, and methods of rationalization. The criteria used in judging the papers are: considerable increase in output performance, improvement of quality of the final products, high economic advantage when incorporated into industry, and better all-round working conditions.

In 1960 none of the papers entered in the N. A. Minkevich Competition merited a first prize.

A second prize amounting to 300 rubles was awarded to a group of authors: V. F. Nikonov, K. Z. Shepelyakovskiy, A. G. Orlovskiy, I. N. Shklyarov, and M. O. Rabin, for their paper "Hardening of the EIL-164 Semi-axle Housing by High-Frequency Tempering and Replacement of Type 40 Kh Steel by Type 45."

The authors worked out a method for hardening the axle housing for the EIL-164 truck by induction-type electrical tempering and anneal. They built and introduced an automatic assembly into the mechanical shop of the Moscow Automobile Factory. The new process permitted replacement of the alloyed type 40Kh steel by type 45 and an annual savings of 23,000 rubles. The assembly is suitable for use in other factories.

Third prize of 100 rubles were awarded to the following:

1. A. Ya. Antyshev and V. G. Kamenov for the paper "High-Frequency Anneal of Check Lines."

The authors developed and introduced into the Kalibr Factory a technique for the casehardening of the working parts of long (to four meters) check lines. The wearability was greatly enhanced and a saving of 5000 rubles per annum achieved.

2. To the group of authors: F. N. Tavazde, Ye. K. Kovshikov,

D. A. Kiknadze, M. M. Aslamazov, and N. P. Larionov, for the paper "An Automatic Signalizer for the Frictionless Anneal of Steel Articles."

A design for the automatic signalization to begin the martensitic transition was developed, proving to be of great practical interest. The apparatus made it possible to completely eliminate breakage due to anneal frictions and to provide an annual savings of 500 rubles. The paper appears in the present publication.

3. To the group of authors: N. V. Lutai, S. P. Umanskiy, D. A. Shamkovich, V. Ye. Kekukh, and V. N. Poturnak, for their paper "A Semiautomatic Arrangement for the Heat Treatment of Parts with Heating in Standard and Modified Equipment Having a Liquid Heating Medium."

The authors developed a system for the mechanization of equipment with a liquid heating medium. The paper is of practical interest, yielding a considerable saving in electrical energy; the over-all economy amounts to 620 rubles. The semiautomatic arrangement has been installed at the Taganrog Combine Factory.

4. To M. Ya. Brovman, A. F. Mel'nikov, I. I. Tsomik, and V. M. Mimukhin for their paper "Low-Temperature Stress Relief in Individual Welded Constructions."

The authors analyzed the origination and relief of stresses in welded metal constructions after low-temperature heating and put into operation the resultant technique at the Southern Ural Machinery Plant.

The stresses in metal constructions are relieved by heating with a burner flame to 250-300° near the weld zone, cooling the weld simultaneously with water.

The manufacturing cycle of welded constructions using this low-temperature heat treatment technique is shortened 25 times. A great savings results.

Honorary recognition was granted to the following by the Central Administration of the Scientific and Technical Division of the Machinery Industry:

1. V. D. Buyadzhi and D. S. Gil'gur for their paper "An Automatic Machine for the Zone Tempering of Thin Disks Using High-Frequency Currents." The automatic equipment has been developed but not put into use. The proposed economy is 880 rubles per annum.

2. L. V. Torgonskiy and G. S. Cherkovskiy for their paper "A Device for the Cooling of Steel Tape After Tempering on A Heat Treating Assembly."

The authors constructed and put into operation a piece of equipment for cooling wide tape after tempering, keeping the surface of the tape even. The annual economy is 410 rubles.

3. V. F. Loshkarev, V. I. Mashkov, A. I. Malyarenko, N. G. Vlasov, and B. I. Golovko for their paper "Internal Frictions in Forged Pieces of Type EI481 Alloy." The paper made it feasible to improve the technology of forge stamping and heat treatment of the alloy EI481.

The Central Administration of the Scientific and Technical Division of the Machinery Industry has begun to accept papers for the 1961 D. K. Chernov and N. A. Minkevich Competitions.

Fifth All-Union Scientific and Technical Conference
on Powder Metallurgy

(by V. S. Rakovskiy)

On 26-29 September 1960 the Fifth All-Union Scientific and Technical Conference on Powder Metallurgy was held in Moscow under the auspices of the Committee on Powder Metallurgy of the Scientific and Technical Division of the Machinery Industry in conjunction with the Institute of Metal Ceramics and Special Alloys, the Ukrainian Academy of Sciences and Committee on Automation and Machinery, Council of Ministers USSR.

Taking part in the conference were representatives of the RSFSR, Belorussian SSR, Ukrainian SSR, Kazakh SSR, and Uzbek SSR. Thirty-five reports were read at the conference, covering the problems of the theory of powder metallurgy, powder metal working, the procurement of metal powders, nature and properties of various new metal ceramic articles, and new technological processes for obtaining metal ceramic products.

The reports tended to reflect the results of scientific investigations conducted at the following institutions: TsNIIChermet [Tsentral'nyy nauchno-issledovatel'skiy institut chernykh metallov -- Central Scientific Research Institute of Ferrous Metals], Giproneftemash [Gosvudarstvennyy nauchno-issledovatel'skiy i proyektnyy institut neftyanogo mashinostroyeniya -- State Scientific Research and Planning Institute for Petroleum Machinery], NAMI [Gosudarstvennyy soyuznyy ordena Trudovogo Krasnogo Znameni nauchno-issledovatel'skiy avtomobil'nyy i avtomotorny institut -- State All-Union "Order of the Worker's Red Banner" Automobile and Automobile Engine Scientific Research Institute], NIITavtoprom [Nauchno-issledovatel'skiy institut transporta avtomobil'noy promyshlennosti -- Scientific Research Institute of Automotive Transportation], the Metallurgy Institute of the Academy of Sciences USSR, Institute of Metal Ceramics and Special Alloys of the Ukrainian Academy of Sciences, VNIEM [Vsesoyuznyy nauchno-issledovatel'skiy institut elektricheskogo mashinostroyeniya -- All-Union Scientific Research Institute of Electrical Machinery], and many others.

Candidate of Engineering Sciences M. Yu. Bal'shin (Metallurgy Institute, Academy of Sciences USSR) gave a report on the problems of generalizing the observed regularities in the pressing and sintering of metal powders. The author demonstrated conclusively that the behavior of the pressing and sintering processes are essentially analogous.

In a very interesting report Prof. G. A. Meyerson (Krasnoyarsk Institute of Nonferrous Metals and Gold) showed that sintering can be strongly activated and its duration greatly curtailed by application of disperse powders, cyclic temperature fluctuations, and etching of the particle surface.

Of considerable practical importance is the electrolytic method for obtaining powders of copper, iron, tin, and others. Until now there have not existed fundamental theoretical postulates characterizing the essence of the process of obtaining metal powders and the influence of various technological factors.

Professor A. M. Levin (Ural Polytechnic Institute) presented in his report the characteristics of this process and analyzed the various factors affecting it. He demonstrated the mechanism for the formation of metal powders in electrolysis.

It was also shown that electrodeposition of metals is complicated by the alkalinization of the electrolyte in the near-cathode region and the formation of hydroxides, which act as growth regulators of the metallic crystals.

The author noted the effect of various technological factors on the dispersion and other properties of metal depositions and indicated certain peculiarities in obtaining individual powder metals, in particular, iron, nickel, copper, silver, etc.

Considerable attention has recently been drawn to ways of obtaining metal ceramic articles by impregnating porous high-melting blanks with molten metals.

Candidate of Engineering Sciences V. N. Yeremenko (Institute of Metal Ceramics and Special Alloys, Ukrainian Academy of Sciences) demonstrated in his report the thermodynamic nature of the physical-chemical bases of this process and gave an equation characterizing the dependence of the saturation rate process constant on the activation energy and temperature.

Some reports were devoted to the technology of obtaining metal powders. Worthy of special attention were the reports of Doctor of Chemical Sciences Prof. I. T. Kudryavtsev and P. I. Mikhaylov (Moscow Chemical Engineering Institute) and the report of Candidates of Engineering Sciences B. A. Borok and V. G. Teplenko, and Engineers V. V. Solov'yeva and I. P. Reutov (TsNIIChermet).

In the first report practical recommendations were given for applying electrolysis to obtain highly disperse iron powders. It was shown that the best results are obtained with a solution of iron sulfate and potassium sulfate additives. Optimum acidity corresponds to a pH of 3-3.5. An apparatus was designed for obtaining highly disperse, homogeneous powders.

In the second report the results of a method designed by TsNIIChermet for obtaining powdered alloys were presented. The method consists essentially in the reduction of oxides or their mixture with hydrides. The method makes it possible to obtain powdered high-quality alloys with nickel, cobalt, iron, chromium, titanium, molybdenum, tungsten, or other metals as the base.

A few reports were concerned with the development of technological processes in powder metallurgy: pressing, sintering, processing of the metal ceramic products.

V. P. Lobashev (TsNIIChermet) described the essential features of

a method for obtaining large-scale blanks of titanium and its alloys by hydrostatic pressing of powders.

Equipment was built enabling the researcher to obtain working pressures as high as 1300 kilograms/square centimeter and to press blanks with a diameter as great as 200 mm and 1000 millimeters or more in thickness.

Engineer A. S. Sarvina (NIITavtoprom) presented a report on the technology of manufacturing metal ceramic piston rings from iron powder. The technology developed by the Institute consists of eight operations, is very simple, and ensures the production of rings far exceeding iron types in quality.

Owing to the presence of micropores, metal ceramic rings are self-lubricating, have small friction coefficients, and have high wearability. Tests have shown that the use of metal ceramic rings makes it feasible to lengthen the lifetime of the engine by an average of 30%.

A. N. Filippov (NAMI) gave in his report the results of a study on the technology of manufacturing anti-friction materials with an aluminum base. This task was fraught with difficulties, in that aluminum powder forms a dense oxide film, which inhibits the sintering of porous materials.

Doctor of Engineering Sciences I. V. Kragel'skiy and co-workers (Machinery Institute, Academy of Sciences USSR, and Metallurgy Institute, Academy of Sciences USSR) presented the results of obtaining metal-plastic friction materials. A theory of dry rubbing was formulated, specifically in application to friction materials. A deeply probing analysis of the essence of dry rubbing and an exhaustive explanation of the significance of the so-called "third body," i.e., the film formed on the surface of a friction material, were given.

On the basis of this theory friction materials representing a combination of metals and plastics were developed, the products of these being prepared by the techniques of powder metallurgy. The materials were subjected to testing with successful results.

In a report by Candidates of Engineering Sciences B. A. Borok and V. G. Teplenko, and others (TsNIIChermet) interesting work done in obtaining parts from titanium, chromium, and vanadium powders and their alloys were discussed. The authors found a technology that would ensure, by the inexpensive, high-production, and simple means of powder metallurgy, the procurement of various products made from the materials, without sacrificing the quality of the cast materials. The technology that they worked out is highly progressive.

Ye. I. Pavlovskaya (Giproneftemash) presented the results of designing metal-ceramic filters with a base of iron granules obtained by wire sputtering. A technology was developed, ensuring the obtainment of oil filters of many shapes and sizes. The filters passed all tests successfully.

In a number of reports the achievements of various factories in the utilization of powder metallurgy were seen. These reports show that powder metallurgy is finding a secure place in industry. For example,

at the Gorkiy Automobile Factory (report by Engineer V. I. Blagin) the production of various metal-ceramic articles has been expanded. A great many products constituting a broad nomenclature are being manufactured. The savings from the application of powder metallurgy came to about 50 thousand rubles at the factory.

At the Minsk Spare Parts Plant (report by O. V. Roman) they have successfully overcome the problems of manufacturing metal-ceramic gears.

This report demonstrated the following:

1. The production of metal powders and metal-ceramic articles shot up a hundred times; scientific research was intensified considerably.
2. Interest in powder metallurgy has increased, and many factories have begun to incorporate this progressive technology.
3. New material have been created, for example, friction materials from iron and aluminum bases, aluminum powder alloy, anti-friction materials with an aluminum base, porous sheet materials, foam metals, heat-resistant and heat-stable materials with a base of high-melting compounds, magnetic materials, etc.

There are, however, some shortcomings:

1. There is no centralized production of metal powders and metal-ceramic articles, the cost of metal powders is still high.
2. The equipment for powder metallurgy is not manufactured on a systematic basis. This makes it unfeasible to set up production of metal powders and metal-ceramic articles on a suitable technological level.
3. Scientific effort is scattered among individual organizations, and the exchange of information between them is inadequate.

The conference adopted a resolution whereby specific measures would be taken to ensure further development of powder metallurgy in the USSR. Recommendations were made for the production of the necessary equipment, research, creation of a scientific research institute for powder metallurgy, and a special journal for powder metallurgy.

- END -